Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

B. Tech. (Industrial Engineering)

Pattern 'B14 Revised'
Effective from Academic Year 2017-18

Prepared by: - Board of Studies in Industrial & Production Engineering

T.Y. B. Tech. Industrial Engineering AY 2017-18 (B14 Revised)

Module 5	Course Code	Course Name	Contact Hours / Week			Credits
			Th.	Proj. Based Lab	Regular Lab	
Semester - I						
S_1	IP301TLP	Optimization and Simulation	3	2	--	4
S_2	IP302THL	Operations Management	3	--	2	4
S_3	IP303THL	Work Study	3	--	2	4
S_4 MOOC	IP304TH	Energy & Environmental Management	3	--	--	3
S_5	IP305TLP	Facilities Planning	3	2	--	4
HSS	HS301OPE	Project Management	2	--	--	2
PD	IP306PD	Professional Development	--	--	2	2
TOTAL			**17**	**4**	**6**	**23**
Semester - II						
S_1 MOOC	IP325TH	Manufacturing Processes & Systems	3	--	--	3
S_2	IP326TLP	Advanced Project Management	3	2	--	4
S_3	IP327THL	Materials Management & Logistics	3	--	2	4
S_4	IP328THL	Statistical Methods & Research Methodology	3	--	2	4
S_5	IP329TLP	Quality Management	3	2	--	4
HSS	HS304OPE	Employability Skills Development	2	--	--	2
Proj	IP330PRJ	Mini Project	--	2	--	2
TOTAL			**17**	**6**	**4**	**23**

IP301TLP Optimization and Simulation

Credits: 4 **Teaching Scheme: 03 Hours / Week**

Unit 1: Introduction & Formulation Of Lp Model (10 Hours)
OR methodology, Definition of OR, Application of OR to engineering and Managerial problems, Features of OR models, Limitation of OR, formulation LPP Models. Definition, mathematical formulation, standard form, solution space, solution – feasible, basic feasible, optimal, infeasible, multiple, optimal, Redundancy, Degeneracy. Graphical and simplex methods. Variants of simplex algorithm – Artificial basis techniques, Big M Method

Unit 2: Queuing Theory (06 Hours)
Queuing Theory: Introduction, terminology, Customer Behaviors, Different Queuing Models, (M /M /1): (GD/∞/∞) Model, , (M /M /1): (GD/N/∞) Model, (M /M /1): (GD/ N / N) Model, (M /M /C): (GD/∞/∞) Model (M /M /C): (GD/N/∞) Model, (M /M /C): (GD/ N / N) Model, Tandem queuing concept- M/Ek/1 Model.

Unit 3: Simulation Modelling (06 Hours)
Simulation: Definition, Introduction to Monte Carlo Simulation., Application, Different Problems solved using Monte Carlo Simulation, Using Applications of Simulation, Generation of Random Numbers. Simulation software, Building Model on Simulation Software, Running the simulation, Understanding the results

Unit 4: Game Theory & Replacement Analysis (06 Hours)
Introduction, two -person zero sum game, minimax and maximin principle, saddle point, methods for solving game problems with mixed strategies, Graphical and iterative methods, solving game by LP Method. Replacement of capital equipments that deteriorates with time, time value of money (a) remains same (b) changes with constant rates during period. Equipment renewal policy, group and individual replacement. Individual Replacement, Group Replacement Policies, Problems

Unit 5: Integer And Dynamic Programming (06 Hours)
Integer Programming: Branch & bound, cutting plane method. Dynamic Programming: Introduction, application, capital budgeting, different problems solved by dynamic programming

Unit 6: Goal Programming & Decision Making Tool (06 Hours)
Goal Programming & Decision Making Tools: Goal Programming-Definition, Introduction, Problems, Analytical Hierarchy Process, Decision Tree – Logic. Decision making under risk (EMV criteria) and Decision making under uncertainty

List of Practicals:

1. Assignment on Sensitivity Analysis in Linear Programming Problems
2. Assignment based on any two Models of queuing theory & Multi stage queuing Model
3. Assignment based on replacement models & Game theory problems.
4. Assignment on Integer programming & on Dynamic programming
5. Assignment on Goal programming and on decision making tools.
6. Health Care System for outpatient treatment of any Multi specialty hospital.
7. Simulation on Multiple stage Queuing application.

Project work based on designing of a simulation model using any available simulation software like Promodel, Simio-3D

Text Books:

1.	Taha H A	Operation Research and Introduction	9th Edition	Pearson Education	2014
2.	Gupta & Hira	Operations Research	Revised Edition	Chand & Co.	2007
3.	Paneerselvam	Operations Research	Second Edition	Prentice Hall of India	2009

Reference Books:

1.	Hiller and Libermann	Introduction to Operation Research	9th Edition	McGraw Hill	2011
2.	S.D. Sharma	Operations Research	15th Edition	Kedarnath, Ramnath & Co	
3.	J K Sharma Pearson Education Pvt	Operations Research	3rd edition	Laxmi Publications	2009

Course Outcomes:

The student will be able to –

1. Formulate a liner programming model and solve it optimally
2. Formulate real life queuing problems and generate optimal solutions
3. Simulate various real life problems and generate optimal solutions
4. Analyze the replacement policies for manufacturing and service sector
5. Develop integer solution for the real life problem by applying various methods
6. Divide a complex problem into no of stages and solve it optimally

IP302THL::Operations Management

Credits: 04 **Teaching Scheme:** 03 Hours / Week

Unit 1: Scope of Operations Management (06 Hours)

Scope of Operations Management - Nature, Scope, Importance. Various Functions in Operations. Types of Production Systems – Project type, Job shop, Batch Production, Flow / Continuous Production, Mass Production - Characteristics and applicability of each type. Operations Strategies: Process choice – Select the appropriate production system, Competitiveness with Operations, Competing on cost, quality, flexibility, speed, reliability. Order Winners & Order Qualifiers. Introduction to ETO, MTO, ATO & MTS

Unit 2: OPC and Material Requirement Planning (MRP I) (06 Hours)

Operations Planning & Control – PPC – Functions, Operations Planning & Control Framework. Material Requirement Planning (MRP I): Inputs to MRP – MPS, BOM –Types of BOM, BOM Explosion, Inventory Transaction Files, MRP Processing (Logic) Time Phased Operation Plan, Numerical on BOM Explosion Netting Requirements, Lot sizing methods.

Unit 3: MRP II (Manufacturing Resource Planning (08 Hours)

Operations Control – Gantt Charts. Planning & Scheduling Techniques: Scheduling v/s Loading, Scheduling Types – Forward Scheduling & Backward Scheduling Scheduling Techniques – SPT, LPT, Johnson's method – Johnson's rule for 2,3 and M machines problem, Slack per operations Critical Ratio, EDD, etc. –Evaluate lateness, tardiness.

Unit 4: Demand Forecasting (08 Hours)

Components of Demand, Techniques of Demand Forecasting – Qualitative (Survey & Judgmental – Delphi, Expert Opinion) & Quantitative(Causal Methods – Input-Output Method, Leading Indicators Method & Time Series Analysis – Moving Average, Exponential Smoothing, Regression Method). Holts Model, Winters Model, Box-Jenkins Model. Measuring Errors in Forecasting – MAD, MFE, MSE & MAPE

Unit 5: Aggregate Planning: (06 Hours)

Introduction, Requirement of Aggregate Plan, Steps in Developing an Aggregate Plan, Advantages of Aggregate Plan, Aggregate Planning Strategies, Planning Options. Selecting the Method in Aggregate Planning, Aggregate Planning in Services Pure Strategies – Chase, Level, Mixed Strategies, Role of Transportation. Detailed Capacity Requirement Planning, Assignment Models, Numerical in Aggregate Planning.

Unit 6:Value Engineering (06 Hours)

Value Engineering: Introduction, Value Engineering / Value Analysis, Relevance of VE in Modern Manufacturing, Process of Value Analysis, VE –Approaches and Aim, Providing Value to the Customers, Benefits, QFD and Rapid prototyping

List of Practicals:

1. Case study assignment on Production Systems
2. Case study assignment on Operations Strategy & Process Choice
3. Assignment on MRP 1 – BOM Explosion
4. Assignment on MRP 1 – Netting Requirements
5. Assignment on Johnson's method for 2,3 and M machines problem
6. Assignment on Dispatching Rules – Critical Ratio, EDD, etc. –Evaluate lateness, tardiness
7. Assignment on Demand Forecasting – Forecast Demand & Measure Error
8. Assignment on quantitative forecasting Techniques
9. Numerical assignment on Aggregate Planning
10. Assignment on various Assignment Models.
11. Case study assignment on Value Engineering
12. Case study assignment on QFD.

Text Books:

1. Panneerselvam, Production & Operations Management, 3rd Edition, McGraw Hill Publications,

Reference Books:

1. Chary, Production & Operations Management –1st Edition, McGraw Hill Publications
2. Chase, Production & Operations Management –1st Edition, Pearson Publications

Course Outcomes:

The student will be able to –

1. Understanding of Operations management strategies and its usefulness.
2. Understanding Of effective measures like using of Lot Sizing mechanisms
3. Understanding different scheduling techniques used in Production system
4. Understanding different Forecasting techniques used in Production system
5. Understanding different Aggregate production strategies used in Production system
6. Understanding of Relevance of Value Engineering in Modern Manufacturing system

IP303THL::Work Study

Credits: 03 **Teaching Scheme:** 3 Hours / Week

Unit 1: Introduction to Work Study **(7 Hours)**
Introduction to Industrial Engineering, Historical background, Contribution of Taylor and Gilbreth, Productivity – Definition, Types, Improvement, Work Content Analysis, Definition and Scope of Work Study, Numerical and Cases on Productivity

Unit II Method Study I **(7 Hours)**
Method Study - Definition, Steps in Method Study, Select – Various Considerations in Select Job for Method Study, Recording – Significance, Need, Charting Symbols, Recording Techniques - Charts and Diagrams, Examine – Questioning Techniques – Primary and Secondary Questions, Numerical and Cases on Recording Techniques

Unit III
Method Study II **(6 Hours)**
Introduction to Principles of Motion Economy, Develop – Alternate Methods of doing Work, Evaluate – Criteria for Evaluating & Selecting Best Method, Define – Develop Standard Operating Procedures, Work Instructions, Implement – Practical Aspects in Implementing New Method, Overcoming Resistance to Change, Maintain

Unit IV
Work Measurement I **(7 Hours)**
Time Study – Definition, Steps, Concept of Observed Time, Basic/Normal Time, Standard Time, Rating – Concept, Types, Allowances – Concept, Types, Application, Calculation of Standard Time, Types of elements, elemental breakdown of tasks, stop watch time Study

Unit V
Work Measurement II **(7 Hours)**
Video time study, Work Sampling procedure, Applications, Advantages. Predetermined Time Standards – Introduction. Methods Time Measurement – Establishing Time Standards using MTM.

Unit VI
Work Measurement III **(6 Hours)**
Introduction to MOST - Basic, Mini and Maxi MOST, General Move, Control Move, Tool Sequence. Application of Work Study in Manufacturing and Service sector, Case studies, Estimation of Standard Time using MOST

List of Practicals:

1. Numerical on Productivity
2. Review of a case study on productivity improvement using Work Study
3. Assignment on Recording Tools & Techniques – Charts
4. Assignment on Recording Tools & Techniques – Diagrams
5. Case – Bagging Exercise – Method Study 1 (Record, Examine,)
6. Case – Bagging Exercise – Method Study 2 (Develop, Evaluate. Define)
7. Case – Toy Assembly – Earth Mover (Two handed process chart)
8. Work Place Design using Principles of motion economy
9. Training in Rating - Dealing Cards
10. Setting Time Standards using Video Time Study
11. Setting Time Standards using MTM
12. Work Sampling Exercise

Text Books:

1. George Kanawaty, Introduction to Work Study, Fourth revised edition, Universal Book Corporation, Bombay, International Labour Office, Geneva

Reference Books:

1. Maynards H.B., Industrial Engineering Hand Book, third edition, New York and London, McGraw- Hill
2. Kjell B. Zandin, MOST© Work Measurement Systems, Second revised edition, Marcel Dekker, Inc, New York and Basel

Course Outcomes:

The student will be able to –

1. Understand and apply productivity concepts and principles and analyze work content
2. Systematically record; critically examine methods of doing work to effect improvements
3. Design the workplace using principles of motion economy and develop improved methods
4. Establish standard time to carry out a specified job using stop watch time study
5. Establish standard time to carry out a specified job using video watch time study
6. Establish standard time to carry out a specified job using predetermined time standards

IP 304TH Energy and Environmental Management

Credits: 3 **Lectures: 3 Hours / Week**

Unit 1: Energy Scenario (6 Hours)

Global, sub continental and Indian, Energy economy relation, Integrated energy planning with particular reference to Industrial Sector in India, Captive power units and others – demand v/s supply. Future energy demand and supply scenario

Unit 2: Types of Energy (7 Hours)

Physical Aspects of Energy: Classification of energy – Hydel, Thermal, Nuclear, Wind, & from Waste Products, Efficiency and effectiveness of energy utilization in Industry, Energy and energy analysis. Renewable and non-renewable energy, Conventional and unconventional energy

Unit 3: Legal Provisions (7 Hours)

Legal provisions in Energy Management and its impact: The Energy Conservation Act, 2003, The Electricity Act, 2003. The Prevention and Control of Pollution Act, 1974, The Energy Conservation Act, 2001, The Environmental Protection Act, 1986, National Electricity Policy, Rural electrification

Unit 4: Demand Side Management (6 Hours)

Energy Demand Management: Energy utilization, Instrumentation and data analysis, Financial aspects of energy management, Energy management as a separate function and its place in plant management hierarchy, Energy Demand Management : Scope, Methodology, modes of energy savings, Plant energy and utility systems, Efficient energy management – Nine steps

Unit 5: Energy Audit and Energy Saving (7 Hours)

Energy Audit: Audit and analysis, Energy load measurements, System evaluation and simulation, Energy saving techniques and guidelines: Administrative control, Proper Measurement and monitoring system, Process control, proper planning & scheduling, Increasing capacity utilization, Improving equipment control, waste heat recovery, Change of energy source. Up gradation of Technology, Change of product specifications, Energy conservation with particular reference to waste heat recovery in different industries; Co-generation and rational operation of production processes. Case study analysis, Provisions under the Electricity Act, functions of Bureau of Energy Efficiency.

Unit 6: Environmental Management (7 Hours)

Significance of Environmental Law -International Environmental Law -Development of International Environmental Law -Source and General principals of International Environmental Law -General rights and obligations of States -General Issues of the international law related to environmental protection -Stockholm Declaration-Rio Declaration on Environment and Development-Basel Convention on the Control of Trans boundary Movement of Hazardous Wastes and their disposal- Convention of Biological Diversity-U.N Frame Work Convention on Climate Change-Montreal Protocol on Substances that deplete Ozone Layer-Kyoto Protocol, Indian Constitution and Environmental Protection - Constitutional provisions concerning Environment: Indian Environmental Policy 2006, Administrative machinery for pollution control Common

Law & Criminal Law Nuisance, Negligence, Strict liability and Absolute liability, Provisions of IPC relating to environmental problems

Text Books:

1.	Chakrabarty Amlan,	Energy Engineering and Management	Kindle Edition	PHI India,	2015
2.		Energy Conservation Act 2001(Act No 52 OF 2001) with short comments,	Edition No.,	Alahabad Law Publishers (India) Pvt Ltd,	2003
3.		Electricity Act 2003(Act No 36 of 2003) Bare Act with short comments		Professional Book Publishers, New Delhi	2003

Reference Books:

1.	Paul W., O'callaghan,	Energy Management,	ISBN 10: 0077076788 / ISBN 13: 9780077076788,	McGraw Hill Book Company, Maidenhead	
2.	Steve Doty, Wayne C. Turner,	Energy Management Handbook	Edition No.6,	Fairmont Press Inc., GA 30047	2007
3.	Barny L. Capehart, Wainey C. Turner, William J. Kennedy	Guide to Energy Management	Edition No. 4	Fairmont Press Inc., GA 30047	2003

Course Outcomes:

The student will be able to –

1. Understand present & future energy scenario, importance of energy conservation & energy efficiency.
2. Study various energy conversion processes & their use to generate energy.
3. Understand and participate to conduct energy audit in an organization.
4. Understand efficient energy management approaches.
5. Understand and undertake Energy Audit
6. Know the origins and sources of environmental laws, and understand how and by whom environmental laws are made and interpreted

IP305TLP Facilities Planning

Credits: **04** **Teaching Scheme:** 3 Hrs/Wk + 2 Hrs/Wk (Lab) + Project

Unit 1: Introduction to Facilities Planning **(7 Hours)**

Scope of Facilities Planning – Importance & Objectives, Nature Of Location Decision, Affecting Facility Location, Single & Multiple Facility Location Models, Qualitative Considerations in Facility Location, Factors Urban v/s Rural Location, Site Selection Location Pattern In India.

Unit 2: Systematic Layout Planning 1 **(6 Hours)**

Plant Layout – Introduction, Types of Plant Layout: Product, Process, Fixed Postion, Hybrid – Cellular, FMS, etc. Phases of Layout Planning,Systematic Layout Planning, P-Q Analysis, Flow of Materials Analysis – Charting & Diagram Techniques, Activity Relationship Analysis – REL Diagram, Space Requirements & Availability, Techniques of Space Determination

Unit 3: Systematic Layout Planning 2 **(7 Hours)**

Systematic Layout Planning: Modifying Considerations, Practical Limitations, Selection of Layout – Techniques of Layout, Installation of Layout, Concept of Line Balancing: Heuristics, Assessing Performance. Computerized Layout Planning – Introduction & Concept. CORELAP, ALDEP

Unit 4: Material Handling **(7 Hours)**

Principles of Material Handling , Material Handling Function, Scope And Functions Of Material Handling , Manual Mechanical Handling Ratio, MH Equipment Types- Positioning Equipment, Unit Load Equipment, Auto Identification & Control Equipment, Transport Equipment – Conveyors, Cranes, Industrial Trucks. Storage Equipment, AGVs & Robots

Unit 5: Systematic Handling Analysis **(7Hours)**

Handling Analysis, External Integration, Classification of Materials, Layout Considerations, Analysis of Moves, Visualization of Moves, Flow Diagram – DI Plot, Preliminary Handling Plans, Modifications & Practical Limitations, Calculation of Requirements, Evaluation of Alternatives, Installation

Unit 6: Maintenance & Safety **(6Hours)**

Role Of Maintenance Management, Organization & Systems Of Maintenance Management, Types Of Maintenance: Breakdown, Preventive, Predictive. Industrial Safety – Training for Safety, Communicating Safety Messages, Safe Practices in Industry, Safety Considerations in Manual & Mechanical Handling, Transportation, Role of Factory Inspector, Safety Officer

List of Practicals:

Student will do exercises or case studies based on following topic

1. Single facility location problems
2. Multiple facility location problems

3. Line Balancing
4. Computerized Layout Planning
5. Layout Evaluation Techniques

AND

List of Project areas:

Students will perform following projects

1. Layout Improvement
2. Material Handling Systems Design

Text Books:

1.	Richard Muther	Systematic Layout Planning	Edition No.,
2.	Richard Muther	Systematic Handling Anaylsis	
3.	Clark,	Facility Planning,	Pearson Education

Reference Books:

1.	James M Apple	Plant Layout and Material Handling
2.	Immer	Plant Layout
3.	Shubin	Plant Layout
4.	Allexande N Rudenko	Material handling Material Handling Equipment

Course Outcomes:

Students will be able to:

1. Select location of facilities for business organizations
2. Learn formulations, models, and analytical procedures for the study of facilities layout planning.
3. Design and improve existing and new layouts incorporating products, process and personnel requirements for manufacturing and service organizations
4. Learn and apply fundamental principles of material handling
5. Select appropriate material handling systems for manufacturing organizations
6. Understand basics of Maintenance and safety measures in industry.

HS301OPE::PROJECT MANAGEMENT

Credits: 02 **Teaching Scheme: -** Theory 2 Hrs/Week

Prerequisites: Nil

Unit I **(8 Hrs)**
Introduction:

Definition & Characteristics of Project, Performance Parameters: Time, Cost & Quality. Difference with respect to Standard Routine Production. Classification of Projects: Sector based, Investment based, Technology based, Causation based, Need based (BMERD) - Balancing, Modernization, Replacement, Expansion & Diversification Project Life Cycle Phases – Concept/Initiation Phase, Project Definition Phase, Project Planning & Organization Phase, Project Implementation Phase, Cleanup & Shutdown Phase. Governmental Framework for Identification of Opportunities, Incentives from state & central govt.; Import-substitution projects.

Unit II **(8 Hrs)**
Project Planning & Organization

Project Planning, Scheduling & Monitoring, Statement of Works, Project Specifications, Work Breakdown Structure, Network Analysis & Duration Estimating Network Diagrams – PERT/CPM, Estimate Activity Times, Milestone Scheduling. Resource Leveling, Resource Smoothening, Project Crashing. Implementation Phase: Activities Involved: Erection & Commissioning, Installation, Trial Runs & Commencement of Commercial Production. Cleanup/Shutdown Phase: Handover to Client, Settlement of Accounts. Project Organization & Management. Project Organization Structure, Role of Project Manager.

Unit III **(8 Hrs)**
Project Monitoring & Contract Management

Project Cost Estimation: Need, Causes of Cost & Time Overruns. Nature of Cost Estimates, Types of Project Cost Estimates, Estimation of Manpower & Utilities. Project Budgeting & Control, Earned Value Management System: Concept of AC, PV, EV, Variances, etc. Contract Management: Responsibility Sharing Matrix, Types of Contract Payments, Risk Factors in Contracts – Contractor & Owner. Critical Chain Project Management. Project Management Information System and Control, Management Pitfalls.

Unit IV **(8 Hrs)**
Computer Applications in Project Planning & Control

Introduction to MS Projects – Understanding the MS Project screen & different views, Defining the project, Working with calendar, Outline the project, Create dependencies between tasks, Creating WBS, Format task list and Gantt chart, Resource planning, leveling and preparing resource graph, Working with baseline, tracking the project. Home Assignment on Exercise with MS Projects Software.

Text Books

1. Narendra Singh; Project Management & Control; Himalaya Publishing House, Mumbai.
2. S. Choudary, Project Management, Tata McGraw Hill
3. Prasanna Chandra; Project: Preparation, Appraisal, Budgeting & Implementation
4. Pinto, Project Management – Achieving Competitive Advantage & MS Projects, Pearson Education

Reference Books

1. Maylor, Project Management, Pearson Education,
2. Gopal & Ramamurthy; Project Management Handbook; Macmilan.
3. Project Management Body of Knowledge
4. Practical Project Management by Ghatak & Sandra, Pearson Education (Singapore) Pte. Ltd, 2001
5. Handbook on Project Appraisal & Follow-up, SARDA, Govind Prakashan,2001

Course Outcomes:

Students will be able to:

1. Learn the basic concepts of project and project management
2. Plan and schedule small and medium projects to achieve the triple constraint of time, cost and quality using software package
3. Understand the concept of earned value management system and critical chain in managing projects
4. Monitor the progress of projects to determine variances and recommend corrective actions using software package

IP325TH Manufacturing Processes & Systems

Credits: 4 **Teaching Scheme: 03 Hours / Week**

Unit 1: Hot And Cold Working Processes (06 Hours)
Forging - Classification of forging processes-open die and closed die forging, stock penetration. Lubrication in tube drawing, Cold rolling, extrusion: forward, backward, impact, Wire & Tube Drawing: Introduction rod and wire drawing machines –Wire drawing dies, material. Forging equipment- Hammers and presses, construction working capacities and selection of equipment. Tube drawing: Methods, force calculation.

Unit 2: Press Working (07 Hours)
Press working terminology, Basic operations, types of presses- mechanical, hydraulic, pneumatic and their mechanisms, elements of die sets, types of die sets, types of dies - simple, compound, progressive, combination and inverted dies, types of punches Methods of reduction of shear force, types of strip layouts, types of strippers, types of pilots, types of stoppers, selection of dowel pins and allen screws

Unit 3: Sheet Metal Working (07 Hours)
Studying of various processes such as shearing, blanking, punching, notching, bending, forming, drawing,

Unit 4: Rolling of Metals (07 Hours)
Scope and importance of rolling. Types of Rolling Mills- Construction and working. Deformation in rolling and determination forces required. Process variables, Roll Defects in rolling. - Roll pass classification & design. Lubrication in rolling Automatic gauge control flattening, Roll camber - its effect on rolling process, mill spring.

Unit 5: Non-Conventional Machining Processes (06 Hours)
Comparison with conventional machining, classification, principle, working advantages, disadvantages and applications of ECM, EDM, AJM, LBM. IBM, EBM

Unit 6: NC/CNC/DNC Systems (07 Hours)
Introduction to NC, CNC, DNC Machines, basic components of NC, NC coordinate system, NC motion control system-point to point, straight cut, contouring, open loop, closed loop. Comparison between NC and Conventional Machine Tools, Basic Principles of NC Machines, its Advantages, NC words, G&M codes, Introduction to Machining Centres-funtions, types, advantages, disadvantages & applications.

Text Books:

1.	Hazra Chowdhary,	Manufacturing Process: Vol. 2.	Revised Edition	Media Promoters	2011
2.	Zimmer & Groover	Computer aided design & manufacturing	1st Edition	Pearson Education	2003

Reference Books:

1.	Chapman W.A	Workshop Tecnnology”	5th Edition	A Butterworth	1972

		Volume I, II,III		Heinemann Title	
2.	Begeman:	Manufacturing Processes	6th Revised edition edition	John Wiley & Sons Inc	1969
3	Roy A. Lindberg: Prentice	Processes and Materials of Manufacture	4th Edition.	Hall of India, New Delhi,	1990.

Course Outcome:

Students will be able to:

1. Understand plastic deformation of metals and its applications
2. Apply the knowledge of press working.
3. Analyze basic sheet metal working processes such as blanking, punching drawing etc.
4. Analyze material forming forces for rolling.
5. Apply the working principles and processing characteristics of advanced machining processes such as ECM, EDM, AJM, LBM, etc.
6. Apply the knowledge of NC CNC and DNC machines

IP236TLP Advanced Project Management

Credits: 03 **Teaching Scheme:** 3 Hours / Week

Unit 1: Project Conceptualization & Feasibility Analysis (6 Hours)
Project Definition Phase: Project Formulation & Feasibility. Types of Feasibility Studies – Pre-feasibility, Support/Functional, Feasibility Study. Preparation of Project Feasibility Report & Specification; Aspects of Project Feasibility Managerial/Organization: Promoters Background, Criteria of Evaluation, Marketing/Commercial: Demand & Supply, Competition, Market Survery, Porter's 5 Forces, Operational/Technical: Process, Technology, Location, Capacity, Labour, Raw Material & Utility Availability. Financial: Cost of Project, Means of Finance, Financial Projections – Profit & Loss Account, Balance Sheet, Funds Flow Statement, Cash Flow Statement, Schedule of Fixed Assets, Schedule of Term Loans.
Socio-Economic: Socio-Cost Benefit Analysis. Effective Rate of Protection, Domestic Resource Cost

Unit 2: Project Resource & Budget Planning (8 Hours)
Time Management – Activity definition, Sequencing, Resource & Duration Estimating, Schedule development, Schedule control, Human Resource - Planning, Acquire Project Team, Develop Project Team, Manage Project Team.
Budget: definition, Input parameters, tools and techniques – Cost Aggregation, etc., Outputs - Cost baseline, project funding requirements.

Unit 3: Project Procurement Management (6 Hours)
Plan Purchases and Acquisitions, Plan Contracting, Request Seller Responses, Selection of Sellers, Contract Administration, Contract Closure. Project supply chain management: - Plan purchasing and acquisitions, plan contracting, contact types, project partnering and collaborations, project supply chain management, Leading and Managing Project Teams.

Unit 4: International Project Management (8 Hours)
Nature & Scope of International Projects, Issues in managing international projects, Selection and training of employees.
Communication – Planning, Information Distribution, Performance reporting, Manage Stakeholders.

Unit 5: Critical Chain Project Management, Project Risk Management (8 Hours)

Risk Management Planning, risk identification, risk analysis, risk response planning, Project Quality Planning and Project Kickoff: Development of quality concepts, project quality management plan, project quality tools, kickoff project, baseline and communicate project management plan.

Unit 6: Advanced Project Planning with MS Projects (8 Hours)
Determining Project Progress and Results: Project Balanced Scorecard Approach,

Internal project, customer, financial issues, Using Microsoft Project to monitor and control projects. Finishing the project: Terminate project early, finish projects on time, secure customer feedback and approval, knowledge management, perform administrative and contract closure, celebrate success and reward participant, provide ongoing support.

List of Practicals:

1. Preparation of Project Feasibility Report
    a. Project Identification, Definition
    b. Project Feasibility – Managerial/Organizational Perspective
    c. Project Feasibility – Marketing, Exit Plan
    d. Project Feasibility – Operational
    e. Project Feasibility – Financial, Financial Projections
2. Assignment on Capital Budgeting – PBP, Discounted PBP, NPV, IRR, Annual Worth
3. Numerical on PERT/CPM – Calculation of Floats, Determination of Critical Path & Project Duration
4. Case let - Project Crashing
5. Case let - Resource Leveling & Resource Smoothening
6. Project Planning & Scheduling (Using MS Projects) 1 – Preparation of Statement of Works, WBS
7. Project Planning & Scheduling (Using MS Projects) 2 – Network Diagram, Gantt Charts, Project Monitoring

Text Books:

1.	Narendra Singh	Project Management & Control	Himalaya Publishing House, Mumbai.
2.	Prasanna Chandra	Project: Preparation, Appraisal, Budgeting & Implementation	
3.	Pinto	Project Management – Achieving Competitive Advantage & MS Projects	Pearson Education

Reference Books:

1.	Maylor	Project Management		Pearson Education	
2.	Gopal & Ramamurthy	Project Management Handbook		Macmilan	
3.	PMI	Project Management Body of Knowledge	3,4,5	PMI	
4.	Ghatak & Sandra	Practical Project Management		Pearson Education (Singapore) Pte. Ltd,	2001
5.	SARDA	Handbook on Project Appraisal & Follow-up		Govind Prakashan	2001

Course Outcomes:

The student will be able to –

1. Learn the basic concepts of project and project management
2. Ascertain the feasibility of small and medium projects with respect to managerial, marketing, operational, financial and socio-economic perspectives
3. Plan and schedule small and medium projects to achieve the triple constraint of time, cost and quality using software package
4. Understand the concept of earned value management system and critical chain in managing projects
5. Monitor the progress of projects to determine variances and recommend corrective actions using software package

IP327THL::Materials Management & Logistics

Credits: 04 **Teaching Scheme:** 03 Hours / Week

Unit 1:Functions of Materials Management (08 Hours)

Functions of Materials Management – Introduction, Classification and Costs of Inventories: Types, Objective of holding inventories, Costs Associated with Inventory - Carrying cost, Procurement cost & Ordering Cost. Different types of Inventories, EOQ - Concept, Assumptions of EOQ Model, EMQ Model -Carrying cost, Set up cost, Shortage Cost. Inventory. Practical Constraints vs Theoretical EOQ Value, Numerical Analysis, Quantity Discounts method. Deterministic Inventory Model- Calculation of EOQ considering Investment, Space Availability

Unit 2: Components of Lead Time - (08 Hours)

Components of Lead Time - Internal and External. Variability in demand and lead time. Probabilistic Replenishment System. Replenishment Systems: Introduction, Concept of lead time and its effects on Safety Stock & Reserve Stock Evaluation. Ways to minimize lead time, Different types of replenishment systems like Fixed order quantity system, Fixed order interval system, Combination of fixed order interval and quantity system, Two Bin System, Symptoms of Poor Inventory management, Selective Inventory Control: Concept of ABC analysis, Selective Inventory Control - VED analysis, HML analysis, SDE analysis, SOS analysis, FSN analysis, GOLF analysis

Unit 3: Purchasing Procedures (06 Hours)

Documents in Procurement, Methods of Buying, Legal Aspects of Buying, Vendor Development, Vendor Selection methods like Vendor Rating Method, Analytical Hierarchy Process (AHP), Saaty rating Scale used In AHP , Categorical Method. Import-Export Procedure – Imports & Exports, Documentation – Bin Cards, Stores Ledger, Goods Receipt Note, Material Requisition, Purchase Order – Format, Terms & Conditions. Documentation in Imports**.**

Unit 4:Logistic Management (06 Hours)

Definition, Logistics Function: Transportation – Significance, Different Transportation Cost elements like Line haul Cost, Pick Up and delivery Cost, terminal handling cost, billing and collecting costs. Different feasible methods used for Calculating Total Transportation cost . Identifying methods for best possible values of Transportation cost. Modes of Transportation – Rail, Road, Pipelines, Water Air, Concept of LTL, FTL in logistic management. relative merits and demerits of Modes of Transportation.

Unit 5:Warehouse Management: (06 Hours)

Warehouse Management: Concept of SKUs, Warehousing Principles & Best Practices, in Receiving, Shipping, Order Picking, Storage & Put away, Warehouse Activity. Profiling,Warehouse Layout Planning. Role of Warehouses like transportation consolidation, product mixing and services. market boundaries, laid down costs, Stores Management:
Functions of Stores, Stores Procedure – Documentation. Need of physical stock taking, method of stock taking like annual, continuous, reorder point stock taking, Inventory records. Surplus and Obsolescent stocks: Introduction, Genesis of surplus materials.

Unit 6: Logistic Outsourcing: (06 Hours)

Introduction, Objectives, Concept of logistics Outsourcing, Catalyst for logistics outsourcing, benefits of logistics outsourcing, issues, third party logistics, fourth party logistics, selection of logistic service provider, logistics service contract, outsourcing value proposition, customer service – key elements of logistics, Introduction, Objectives, Concept, Attributes of customer service, different phases of customer services, value added logistical service. customer service for competitiveness.

List of Practicals:

1. Assignment on Costs of Inventories, Assignment on EOQ
2. Assignment on EOQ – Practical Constraints – Quantity Discounts, Shelf Life, Packing Constraints
3. Assignment on Replenishment Systems – Deterministic Model
4. Assignment on Replenishment Systems – Probabilistic Model
5. Numerical Assignment based on Vendor Rating
6. Numerical Assignment based on AHP Method used for – Vendor Selection
7. Numerical Assignment based on transportation costs like Terminal Handling Cost
8. Case – Warehouse Layout Planning
9. Comprehensive Case on Warehousing
10. Study of Inbound & Outbound Logistics Channels of a Any Industry

Text Books:

1. Panneerselvam, "Production & Operations Management",3rd Edition, McGraw Hill Publications,

Reference Books:

1. Chary, "Production & Operations Management" –1st Edition, McGraw Hill Publications
2. Tony Arnold, "Materials & Operations Management" –1st Edition, Pearson Publications

Course Outcomes:

The student will be able to –

1. Understanding of Functions of Materials Management and its usefulness.
2. Understanding Of Components of Lead Time
3. Understanding different purchasing systems used
4. Understanding different transportation techniques & modes used
5. Understanding warehouses and SKU used in Production system
6. Understanding of logistics Outsourcing & customer service

IP328THL:: Statistical Methods and Research Methodology

Credits: 04 **Teaching Scheme:** 3 Hours / Week

Unit 1: Data in Research (6 Hours)
Meaning of Research**,** Motivation for Research **,** Research Approaches, Criteria for Good Research, Importance of communication skills in Research, Technical writing skills, Objectivity and Ethics in Research, Steps in Research process, Data in Engineering and Management Research, Types of data, Measures of Frequency Distribution

Unit 2: Probability Distributions (8 Hours) Review of Probability Theory, concept of Random Variable, Discrete probability distributions in statistics and their analysis, Continuous probability distributions in statistics and their analysis , Functions in MS EXCEL for probability distributions

Unit 3: Estimation in statistics (6 Hours)
Sampling Distributions, Central Limit theorem, Chebyshev's Theorem, Point estimation, Interval Estimation, Confidence Intervals, Sample size determinations for means and proportion, Large sampling versus small sampling, Methods of sampling

Unit 4: Tests of Significance for Means and Proportions (8 Hours)
Concept of significance level, Test of Significance for single mean and proportion, Errors in Hypothesis Testing, Test of significance for two sample means and proportions

Unit 5: Tests of significance for variance (8 Hours)
Chi-square distribution, Test of significance for one sample and two sample variance. Test of independence, Test of goodness of Fit, F distribution, One way ANOVA, Introduction to Design of Experiments

Unit 6: Research Methodology (6 Hours)
Methods of primary and secondary data collection, Exploratory versus Descriptive research , Scales of Measurement, Aspects of Questionnaire design, Design of field surveys, Use of Regression and correlation in research analysis and forecasting,

List of Practical:
1. Measures of Frequency Distribution
2. Discrete Probability Distributions
3. Continuous probability Distributions
4. Central Limit Theorem
5. Estimation in Statistics
6. Test of significance for means
7. Test of significance for proportion
8. Test of significance for variance
9. Test of independence
10. ANOVA

List of Project areas:

1. Questionnaire design
2. Exploratory Research using secondary data
3. Exploratory Research using primary data
4. Descriptive Research
5. Data analysis in MS Excel

Text Books:

1. Richard Johnson, Probability and Statistics for Engineers, Eighth edition, Prentice Hall of India
2. Srivastava U.K., Shenoy G. V. and Sharma S.C, Quantitative Techniques for Managerial Techniques, Third edition, New Age International Publishers
3. Krishnaswamy K. N., Sivakumar A.I. and Mathirajan M., Management Research Methodology" Pearson publication
4. Kothari C. R., Research Methodology, Second Edition, New Age International Publishers

Reference Books:

1. Levin Richard and Rubin David, Statistics for Management, Prentice Hall of India
2. Murray Spiegel, Schiller John, Srinivasan R. A. and Goswami Debasree, Probability and statistics (Schaum's outline Series), Third Edition, McGraw Hill
3. Paneerselvam R., Research Methodology, Second Edition, Prentice Hall of India
4. Paneerselvam R., Design and Analysis of Experiments, Prentice Hall of India

Course Outcomes:

The student will be able to –

1. Explain the nature of research and data requirements
2. Calculate probability by selecting appropriate probability distribution for managerial decisions
3. Estimate confidence interval
4. Perform test of significance for means and proportion
5. Perform test of significance for variance
6. Assess the appropriateness of different kinds of research designs and methodology

IP329TLP :: QUALITY MANAGEMENT

Credits: 04 **Teaching Scheme: -** Th.3 + Lab 2 (Hrs/Week)

Unit I **(06 Hrs)**

Introduction to Quality

Introduction: Meaning of Quality, Characteristics of Quality, Quality of Product versus Quality of Service, Cost of Quality – Prevention Costs, Appraisal Costs, Value of Quality, Cost-Quality Trade-off. Approaches to Quality as proposed by Deming, Juran and Crossby, Voice of Customer, Quality Function Deployment – Constructing House of Quality for a Specific Product

Unit II **(07 Hrs)**

Statistical Process Control

Statistical Process Control: Variations – Concept, Causes – Random & Assignable, Difference – Process in Control versus Process is Capable, Introduction to Statistical Process Control: Control Charts, X-bar, R, p, np and C Charts, Concept of Process Capability (Cp) & Process Capability Index Index (Cpk). Six Sigma Limits, Applications of Control Charts in Mass Production and Process Production

Unit III **(07 Hrs)**

Acceptance Sampling

Acceptance Sampling: 100% Inspection versus Sampling Inspection. Concept of Producer Risk and Consumers Risk. Operating Characteristics Curve. Evaluating sampling plans (AOQ, ATI, ASN), Sampling Plan – Single Sampling Plan versus Double Sampling Plan. Design Sampling Plan on the basis of MIL, ASQ Standards.

Unit IV **(07 Hrs)**

Quality Improvement Tools

Introduction to TQM & Quality Circles, Quality Improvement Tools: 7 QC Tools – Check Sheet, Histogram, Pareto Chart, Fishbone Diagram, Run Charts, Scatter Diagram, Process Flow Chart. 7 QM Tools – Program Decision Process Chart, Tree Diagram, Affinity Diagram, Prioritization Matrix, Matrix diagram and Arrow diagram; Bench Marking, Quality Improvement Tools: Why-Why Analysis, Root Cause Analysis, Poka Yoke (Mistake Proofing)

Unit V **(07 Hrs)**

Six Sigma & Quality Management Systems

Introduction to Six Sigma: Definition, Concept, Methodology. Six Sigma Approaches – Design for Six Sigma (DFSS) Approach & DMAIC Approach, Six Sigma Tools
Importance and overview of ISO 9000: Standard clauses, Introduction to TS16949, ISO 9000 Certification: Certifying Bodies & Accreditation Agencies, Necessity for Certification & Certification Process, Benefits of Certification. Malcom Baldrige National

Unit VI **(06 Hrs)**

Reliability

Concept of probability, reliability-definition, Life cycle curve and distribution of failure and repair times; determination of MTBF and MTTR, reliability models; Evaluation of overall system reliability, Active and Passive Redundancy, system availability and maintainability, Preventive maintenance

List of Practicals:

1. Determination of parameters of variable control charts and process capability
2. Determinations of parameters of attribute control charts
3. Selection of sampling plan using MIL, ASQ standards
4. To determine single sampling plan for stipulated producer's and consumer's risk.
5. Case on application of 7 quality control tools
6. To determine overall system reliability

List of Project areas:

1. Quality Function Deployment
2. Six Sigma

Text Books

1. Amitava Mitra, Fundamentals of Quality Control & Improvement, second edition, Pearson Education
2. Phadke, Quality Engineering using Robust Design, Pearson Education

Reference Books

1. J.M. Juran & F.M.Gryna , Quality Planning and Analysis.
2. Juran's Quality Control Handbook.
3. E.L.Grant & R.S. Kearenworth, Statistical Quality Control.
4. Kaoru Ishikawa, Guide to Quality Control, Asian Productivity Organisation, Tokyo.
5. ISO 9000 Quality Management System , International Trade Center, Geneva
6. Ebeling CE; An Introduction To Reliability & Maintainability Engg; John Wiley and Sons

Course Outcomes:

Students will be able to:

1. Understand and apply principles of quality management
2. Interpret for process control, identify and analyze and eliminate/reduce causes of variation and carry out process capability studies
3. Select and design an acceptance sampling plan for sampling inspection
4. Develop an ability of problem solving and decision making using quality improvement tools
5. Understand and apply Six Sigma Methodology and QMS and its applications
6. Evaluate reliability, maintainability and availability of product/component systems

IP330PRJ :: MINI PROJECT

Credits: 02 **Teaching Scheme: -** Laboratory 2 Hrs/Week

Prerequisites: Nil

Guidelines

1. Mini Project can be an individual or a group activity depending on the depth and scope of the topic.
2. The project work can be any of the form given below (but not restricted to below mentioned topics only) :
   a) Making physical working models, prototypes, scaled models, of a concept machine.
   b) Making virtual / CAD models of machines / concepts.
   c) Making study, modeling, analysis, programming and simulation of a system / machine operation / process.
   d) Making study / teaching modules of a sufficiently complex topic for pedagogy purposes.
3. A complete assembly and details drawings of the project should be submitted along with a detailed project report, where applicable.
4. A Detailed background / field / literature survey, related to the topic must be made presented in the report.
5. Entire work should be presented at the end of the Semester.

Course Outcomes :

Students will be able to

1. Survey literature for problem identification.
2. Apply basic engineering fundamentals in the domain of practical applications to analyze a concept/system/machine operation/process etc.
3. Cultivate the habit of working in a team and attempt a problem solution in a right approach
4. make physical working model/charts/prototype/scaled model/ CAD model etc, carry out a survey/ conduct experimentation
5. prepare project report and present at the end of semester